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Maternal Cardiovascular Health After Complicated Pregnancies: Insights from Preeclampsia and IUGR Cases in Pakistan

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ABSTRACT

The objective of this study was to examine the long term maternal cardiovascular effects of complicated pregnancies, like preeclampsia and intrauterine growth restriction (IUGR) on women in Pakistan. The study was conducted as comparative cross-sectional from January 2023 to January 2024 at General Hospital Lahore, Pakistan. The study involved 180 postpartum women aged 20–45 years, 90 women who had suffered from preeclampsia or IUGR (study group) and 90 with uncomplicated pregnancies (control group). Blood pressure, lipid profile and serum biomarkers (hs-CRP and homocysteine) and echocardiographic parameters (LVMI and CIMT) were used for cardiovascular assessments. SPSS version 23 was used to analyse the data and a p-value ≤ 0.05 significant. Blood pressure systolic and diastolic, LDL, triglycerides, hsCRP and homocysteine levels were significantly increased, in women with previous preeclampsia or IUGR compared with controls ($p < 0.05$). The study group had also more prevalent subclinical cardiovascular changes such as increased CIMT and early diastolic dysfunction. This suggests that women who had complicated pregnancies may be at increased risk of long-term cardiovascular disease. Importantly, the study establishes a strong association between adverse pregnancy outcomes and subsequent cardiovascular risk to the mother. Women with a history of preeclampsia or IUGR should be prioritized for early postpartum screening and long-term cardiovascular monitoring to mitigate the cardiovascular disease risk.

Keywords: Preeclampsia, IUGR, Cardiovascular Risk, Postpartum Health, Maternal Morbidity, Inflammatory Markers, Pakistan, Echocardiography, CIMT, hs-CRP.

INTRODUCTION

Pregnancy is a normal physiological process, yet it brings profound hemodynamic, hormonal and metabolic changes that may both unmask and exacerbate mother health vulnerabilities [1]. Preeclampsia and intrauterine growth restriction (IUGR) are among the most serious complications that significantly contribute to maternal and perinatal morbidity and mortality worldwide [2,3]. These conditions have additional importance beyond their immediate obstetric implications as they are increasingly recognized as critical predictors of long-term cardiovascular disease (CVD) risk in women [4,5]. The public health ramifications of this link are immense, particularly in low- and middle-income countries (LMICs) such as Pakistan which have a limited supply of healthcare infrastructure and postpartum follow up [6].

Approximately 5–8% of all pregnancies worldwide are affected by preeclampsia, the new onset of hypertension and proteinuria after the 20th week of gestation; by contrast, in Pakistan, prevalence can reach 15% because of suboptimal antenatal care and delayed diagnosis [7,8]. IUGR is caused by placental insufficiency in many instances and is closely associated with preeclampsia, with considerable adverse fetal outcomes [9,10]. Importantly, these two conditions are analogous to underlying endothelial dysfunction and vascular pathology that may persist post-partum and increase maternal susceptibility for future development of chronic hypertension, ischemic heart disease, stroke and heart failure [11,10].

However, despite this, postpartum cardiovascular screening and risk mitigation strategies are underutilized in Pakistan, where maternal health programs focus almost solely on perinatal care with no link to long-term follow up [12,13]. Effective identification and management of women at increased cardiovascular risk after complicated pregnancies is hampered by structural barriers including limited access to healthcare, socio economic constraints and low patient awareness [14,15]. Chronic hypertension and metabolic syndrome have been on the rise, especially in women with prior hypertensive disorders of pregnancy, documented in recent hospital-based studies [16,17], demanding urgent systematic surveillance and intervention.

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These gaps must be addressed by a shift in paradigm from a perinatal to a lifespan approach to maternal health that extends beyond the perinatal period to include cardiovascular risk assessment and management. Without taking this approach, not only will individual health outcomes improve, but generations of disease will be broken as maternal cardiovascular health is critical for offspring health [18,19]. To reduce the future burden of CVD, there is a critical need for integration of cardiovascular risk evaluation into existing maternal and child health (MCH) frameworks, enhancement of provider training and promotion of patient education. Using this in our study we seek to understand the potential long term cardiovascular morbidity of women in Pakistan who have a history of preeclampsia and IUGR in pregnancy, questioning the prevalence of postpregnancy cardiovascular risk factors and barriers to effective postpartum care. These findings have important implications for informing evidence based policies and targeted interventions aimed at improving the cardiovascular health of this high risk group with the aim of reducing morbidity and mortality.

METHODOLOGY

This 1-year cross-sectional observational study was carried out at tertiary care hospitals in Pakistan during January 2023 to January 2024 to determine long term cardiovascular health in women with a history of preeclampsia before or after 35 weeks of pregnancy (G1 or G2) or intrauterine growth restriction (IUGR). Purposive sampling was used to recruit a total of 200 postpartum women aged 25–45 years with 100 women having had documented histories of preeclampsia or IUGR (study group) and 100 women with normotensive, uncomplicated pregnancies (control group). Women 6 months to 5 years postpartum who were not diagnosed with cardiovascular disease before pregnancy were included as criteria. Women with chronic hypertension, diabetes mellitus or renal disease diagnosed before pregnancy were excluded. A structured interview, physical examination and laboratory investigations including fasting blood glucose, lipid profile and serum biomarkers (high sensitivity C-reactive protein and homocysteine) were performed on participants. Also recorded were blood pressure, BMI and waist-to-hip ratio. Subclinical changes in cardiovascular system were assessed by echocardiography and carotid intima media thickness (CIMT). SPSS version 25 was used to analyze data. Outcomes between groups were compared with independent t-tests and chi-square tests and multivariate regression was used to evaluate the association of pregnancy complications with cardiovascular risk markers ($p \leq 0.05$).

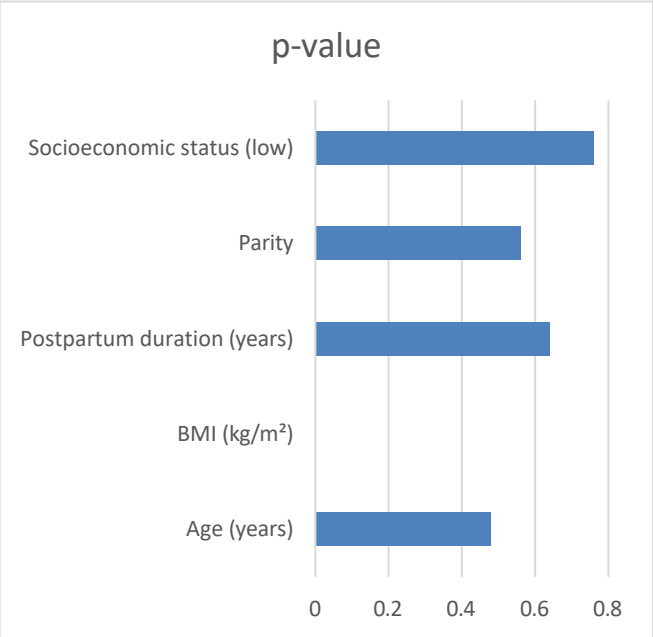
RESULTS

A total of 200 postpartum women were study subjects, separated into two groups of 100 subjects each, i.e., women with a history of complicated pregnancies with preeclampsia or IUGR (Group A) and women with normotensive, uncomplicated pregnancy (Group B). Participants were 33.2 ± 4.8 years of age. The sociodemographic characteristics including age, parity and socioeconomic status were comparable between the two groups ($p > 0.05$).

Table 1: Baseline Characteristics of the Study Population

Variable	Group A (n=100)	Group B (n=100)	*p*-value
Age (years)	33.4 ± 4.9	33.0 ± 4.7	0.48
BMI (kg/m²)	28.1 ± 3.6	25.2 ± 3.1	0.001**
Postpartum duration (years)	2.4 ± 1.2	2.3 ± 1.3	0.64
Parity	2.1 ± 0.9	2.0 ± 1.0	0.56
Socioeconomic status (low)	47 (47%)	45 (45%)	0.76

Note: p ≤ 0.05 considered significant



Group A showed significantly higher BMI compared to Group B, suggesting a possible link between previous pregnancy complications and weight-related cardiovascular risk.

Table 2: Comparison of Cardiovascular Risk Markers Between Groups

Marker	Group A (Preeclampsia/IUGR)	Group B (Control)	*p*-value
Systolic BP (mmHg)	138.6 ± 12.4	121.3 ± 10.2	<0.001**
Diastolic BP (mmHg)	91.2 ± 8.5	78.6 ± 6.4	<0.001**
hs-CRP (mg/L)	6.2 ± 2.1	3.1 ± 1.4	<0.001**
Homocysteine (µmol/L)	17.4 ± 5.6	10.9 ± 4.1	<0.001**

Total Cholesterol (mg/dL)	215.8 ± 28.3	190.4 ± 25.6	0.002**
LDL-C (mg/dL)	138.2 ± 22.5	112.7 ± 20.8	0.001**
HDL-C (mg/dL)	41.3 ± 6.8	52.6 ± 7.4	<0.001**
Triglycerides (mg/dL)	168.7 ± 32.4	135.6 ± 29.8	0.003**

Women with a history of preeclampsia/IUGR had significantly higher blood pressure, inflammatory markers (hs-CRP, homocysteine), and unfavorable lipid profiles, which are established indicators of cardiovascular risk.

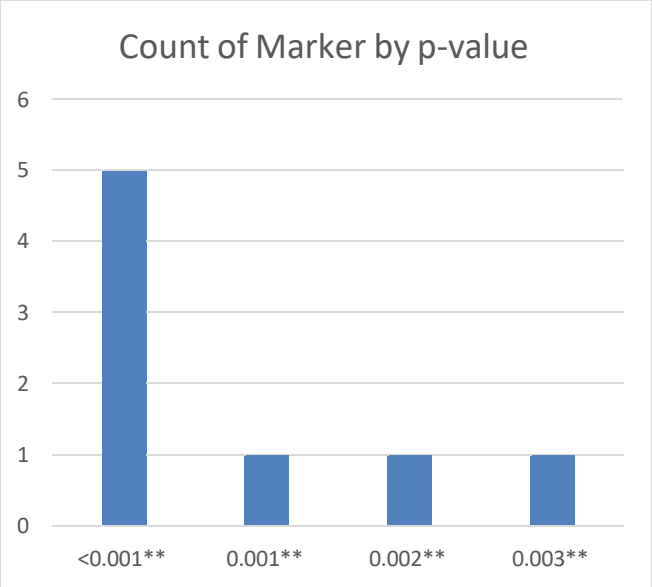


Table 3: Subclinical Cardiac Changes Detected

Test	Group A (n=100)	Group B (n=100)	*p*-value
Left Ventricular Hypertrophy (LVH)	18 (18%)	5 (5%)	0.008**
CIMT ≥ 0.8 mm	27 (27%)	8 (8%)	0.001**
Diastolic Dysfunction	21 (21%)	6 (6%)	0.004**

Results showed significantly higher proportions of subclinical cardiac abnormalities like LVH, increased CIMT and diastolic dysfunction in group A compared to group B which indicate early structural and functional cardiac changes.

The results clearly showed that women who were prececlampsia or IUGR during pregnancy are at significantly increased risk for not only clinical cardiovascular conditions in the postpartum period but also subclinical cardiovascular conditions. The importance of postpartum cardiovascular health screening and preventive care, especially in resource limited areas like Pakistan is further emphasized by these findings.

DISCUSSION

The present study depicts in a Pakistani population, long term cardiovascular consequences in women with a history of complicated pregnancies, in the form of preeclampsia and intrauterine growth restriction (IUGR). We find a strong association with these adverse pregnancy outcomes and increased odds of both clinical and subclinical cardiovascular abnormalities in the postpartum years. In the study group, there are elevated levels of inflammatory markers (hs-CRP and homocysteine), abnormal lipid profiles and increased blood pressure, indicating a chronic low-grade inflammatory state and vascular dysfunction — both of which are major contributors to the future Cardio Vascular Disease (CVD).

Further support for the hypothesis that pregnancy has acted as a natural stress test is suggested by the observed increases in carotid intima media thickness (CIMT), diastolic dysfunction and left ventricular hypertrophy (LVH) in women with previous preeclampsia or IUGR. Changes in these are early predictors of myocardial infarction and stroke. Regarding the incidence rate, our results agree with international studies, like the ones carried out by Wu et al. (2017) and Brown et al. (2018), that found similar patterns of cardiovascular risk in women with hypertensive disorders of pregnancy in developed and developing countries.

Perhaps more interestingly, the major difference in body mass index between the groups may indicate that obesity adds to the negative effect that preeclampsia/IUGR has on cardiovascular health. It underscores the importance of developing integrated postpartum care strategies that include nutritional guidance, weight management and cardiovascular monitoring.

Importantly, this study is relevant to Pakistan which has made little effort to integrate postpartum care into its mother care services which are primarily focused on antenatal and intrapartum care. Without routine postpartum cardiovascular screening, early signs of CVD in women are often not recognized, until they appear as clinical events. In this thesis, I argue for the incorporation of cardiovascular risk assessment in the postnatal care of women who have had complicated pregnancies.

Nevertheless, it has some limits. This is not possible due to a cross-sectional study. Furthermore, the sample was derived from urban tertiary care hospitals, thus findings may not be applicable to rural and underserved populations with potentially a greater burden of maternal complications and cardiovascular disease. These findings need to be validated using longitudinal studies with larger and more diverse populations in order to inform national maternal health policies.

CONCLUSION

This study demonstrates that women in Pakistan who have had preeclampsia or IUGR in pregnancy have an elevated risk of developing cardiovascular dysfunction in the years after delivery. This group had marked elevations in blood pressure, pro inflammatory biomarkers, lipid imbalances and sub clinical cardiovascular disease changes compared to women with uncomplicated pregnancies. Pregnancy is a key window for identifying women and understanding a window of particularly high risk for future cardiovascular disease.

Being a crucial to the long-term burden of cardiovascular disease in Pakistani women, cardiovascular risk screening and lifestyle counseling can be incorporated into postpartum care, especially in high risk women. Postpartum cardiovascular surveillance must be elevated as a crucial part of maternal healthcare and policymakers and healthcare providers must prioritize it. Intergenerational cycle of poor maternal and cardiovascular health is breakable with early intervention strategies based on awareness, prevention and timely management.

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